1MEMS4 Introduction to Computing [5 credits]

Lecturer(s): Mr. Seamus O’ Shaughnessy (oshaugse@tcd.ie),

Module organisation

<table>
<thead>
<tr>
<th>Semester: 2</th>
<th>Lecture/week: 1</th>
<th>Labs/week: 3 hours</th>
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<tbody>
<tr>
<td>Duration (weeks): 11</td>
<td>Total: 11</td>
<td>Total: 33</td>
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Module description, aims and contribution to programme

- Introduction: computer components and what computers are used for
- Programming statements, algorithms, debugging,
- Machine number representation: binary and floating point numbers
- Data types,
- plotting data
- matrix operations using Matlab
- Boolean logic
- Control structures in programming: loops
- Importing and exporting data
- Use of functions and sub-functions

Learning outcomes

On successful completion of this module, students will (be able to):

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Relevant PA/PO</th>
<th>Samples of assessment</th>
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<tbody>
<tr>
<td>1. Understand the concepts of constants and variables in computer programming</td>
<td>a(i-iv)</td>
<td>Assignment, 2012.1, 2010.1</td>
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<tr>
<td>2. Write basic sequential programs using Matlab to analyze engineering problems</td>
<td>b(i-v), c(i-v)</td>
<td>Assignment, 2012.2</td>
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<td>3. Use programming control structures such as conditional statements and loops to execute algorithms</td>
<td>a(i-iv)</td>
<td>Assignment, 2012.3</td>
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<td>4. Use functions and sub-functions, including library and user-defined functions</td>
<td>a(i-iv)</td>
<td>Major Assignment</td>
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<td>5. Process textual information</td>
<td>a(i-iv)</td>
<td>Assignment, 2012.4</td>
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<tr>
<td>6. Use data structures and cell arrays</td>
<td>a(i-iv)</td>
<td>Major Assignment</td>
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<tr>
<td>7. Low-level read and write to and from file storage</td>
<td>a(i-iv)</td>
<td>Assignment, 2012.4</td>
</tr>
<tr>
<td>Module number</td>
<td>Assignment</td>
<td>Reference</td>
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<td>8.</td>
<td>Plot data using MATLAB</td>
<td>d(ii)</td>
</tr>
<tr>
<td>9.</td>
<td>Translate a design brief into a robust, functioning program</td>
<td>b(i-ii), c(i-iii)</td>
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<td>10.</td>
<td>Layout, comment, explain and debug code</td>
<td>c(iv), g(v)</td>
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**Module content**

- Introduction to manufacturing processes and systems. The relationship between material selection, product design, manufacturing decisions, product uses and safety and environmental considerations.
- Introduction to engineering materials: ferrous and non-ferrous metals and polymers, basic manufacturing processes and material properties – elasticity, plasticity, ductility, toughness.
- Introduction to stress, strain, yielding and plastic flow.
- Crystal structure of metals, dendrite formation, recrystallisation, hot and cold working.
- Introduction to Turning, Milling and Drilling.
- Introduction to the technology associated with forging, rolling, extrusion, wiredrawing, piercing and blanking, bending, casting, joining processes and polymer forming. Advanced technologies, such as for the production of coatings and LASER material processing are also introduced.
- Calculations of forming forces and tool/workpiece stresses for the most conventional processes.
- Basic machine tool structure and terminology.

**ASSOCIATED LABORATORY/PROJECT PROGRAMME**
Weekly laboratory assignment associated with each aspect of the syllabus

**Teaching Strategies**

This module is not the study of computer science, but rather it teaches students to use computers to aid in the analysis of engineering problems. The module is taught using a combination of lectures and computer laboratories. Each week there is one podium lecture where new material is introduced and discussed. There is a two hour laboratory session where each student sits at a dedicated PC and works on that week's assignments. There is also an additional one hour laboratory session in which difficult aspects of the previous session are revised and a new assignment is worked on. This final session allows for a degree of equalizing of students’ progress on the essential aspects of the module. Assistance is available during these sessions from both the course lecturer and a teaching assistant

Two major assignments, bringing together the key concepts taught in the module. These are given before reading week and in the final weeks of the module. Students are required to present their code individually, explaining the logic of their code and the implications of making any changes, and to provide evidence of a structured development towards meeting the assignment objectives.
Assessment

Graded computer laboratory assignments and attendance (100%).
Continuous Assessment (100%)

Required textbook

- Matlab: A Practical Introduction (Paperback), Attaway, Butterworth-Heinemann, 2009

SUPPLEMENTARY TEXT(S)

- Introduction to Matlab 7; Etter, Kuncicky & Moore, Prentice Hall, 2005
- Introduction to Engineering Programming, Solving Problems with algorithms, Holloway, Wiley, 2004

Further Information